

## CLAIMS

1. In an isotope gas analysis in which gas to be measured  
or an expired breath of a human being containing, as gas  
5 components, carbon dioxide  $^{13}\text{CO}_2$  and carbon dioxide  $^{12}\text{CO}_2$ ,  
is introduced into a cell, and the intensities of transmitted  
lights having wavelengths suitable for measurement of the  
respective gas components, are measured and then data-  
processed to measure the concentration of the carbon dioxide  
10  $^{13}\text{CO}_2$ ,

a gas injection amount determining method comprising  
the steps of:

filling the cell with the air at an atmospheric  
pressure;

15 operating a gas injection device so as to suck the  
air of a predetermined volume  $V_a$ , the gas injection device  
being arranged to inject the gas to be measured into the  
cell;

transferring the air stored in the gas injection device  
20 into the cell to pressurize the cell inside, and measuring  
the cell inside pressure  $P$ ; and

subtracting the cell volume  $V_c$  from the product  
obtained by multiplying the sum  $V_0$  of the volume  $V_a$  and the  
cell volume  $V_c$ , by the ratio  $P_0/P$  in which  $P_0$  is the target  
25 pressure of the gas to be measured in isotope gas analysis

measurement, thus determining the one-time gas injection amount of the gas injection device.

2. A gas injection amount determining method according to Claim 1, wherein the cell volume  $V_c$  includes a net volume of the cell and volumes of pipes, valves, and a pressure sensor which are in connection through the cell.

3. A gas injection amount determining method according to Claim 1 or Claim 2, wherein the target pressure  $P_0$  of the gas to be measured is equal to the gas pressure at which a calibration curve for determining the relationship between absorbance and concentration of carbon dioxide  $^{13}\text{CO}_2$ , has been prepared.

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4. In an isotope gas analyzing and measuring method in which gas to be measured or an expired breath of a human being containing, as gas components, carbon dioxide  $^{13}\text{CO}_2$  and carbon dioxide  $^{12}\text{CO}_2$ , is introduced into a cell, and the intensities of transmitted lights having wavelengths suitable for measurement of the respective gas components, are measured and then data-processed to measure the concentration of the carbon dioxide  $^{13}\text{CO}_2$ ,

the isotope gas analyzing and measuring method comprising the steps of:

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filling the cell with the air at an atmospheric pressure;

operating a gas injection device so as to suck the air of a predetermined volume  $V_a$ , the gas injection device  
5 being arranged to inject the gas to be measured into the cell;

transferring the air stored in the gas injection device into the cell to pressurize the cell inside, and measuring the cell inside pressure  $P$ ;

10 subtracting the cell volume  $V_c$  from the product obtained by multiplying the sum  $V_0$  of the volume  $V_a$  and the cell volume  $V_c$ , by the ratio  $P_0/P$  in which  $P_0$  is the target pressure of the gas to be measured in isotope gas analysis measurement, thus determining the one-time gas injection  
15 amount of the gas injection device; and

collecting gas to be measured having the volume thus determined, by the gas injection device, transferring the gas thus collected, into the cell containing gas to be measured at an atmospheric pressure, thereby to pressurize the cell  
20 inside, and measuring the concentration of carbon dioxide  $^{13}\text{CO}_2$  or the concentration ratio  $^{13}\text{CO}_2/^{12}\text{CO}_2$ .

5. An isotope gas analyzing and measuring method according to Claim 4, wherein the cell volume  $V_c$  includes  
25 a net volume of the cell and volumes of pipes, valves and

a pressure sensor which are in connection through the cell.

6. In an isotope gas analyzing and measuring apparatus in which gas to be measured or an expired breath of a human being containing, as gas components, carbon dioxide  $^{13}\text{CO}_2$  and carbon dioxide  $^{12}\text{CO}_2$ , is introduced into a cell, and the intensities of transmitted lights having wavelengths suitable for measurement of the respective gas components, are measured and then data-processed to measure the concentration of the carbon dioxide  $^{13}\text{CO}_2$ ,

the isotope gas analyzing and measuring apparatus comprising:

a gas injection device for injecting gas into the cell;  
gas transferring means for transferring the gas stored in the gas injection device into the cell;

a pressure sensor for measuring the pressure of the gas housed in the cell; and

gas injection amount determining means arranged such that the air having a predetermined volume  $V_a$  is sucked by the gas injection device, that the air stored in the gas injection device is transferred to the cell filled with the air at an atmospheric pressure, thereby to pressurize the cell inside, that the cell inside pressure  $P$  is measured, and that the cell volume  $V_c$  is subtracted from the product obtained by multiplying the sum  $V_0$  of the volume  $V_a$  and the

cell volume  $V_c$ , by the ratio  $P_0/P$  in which  $P_0$  is the target pressure of the gas to be measured in isotope gas analysis measurement, thus determining the one-time gas injection amount of the gas injection device;

5           whereby gas to be measured having the volume determined by the gas injection amount determining means, is collected by the gas injection device, the gas thus collected is transferred into the cell filled with gas to be measured at an atmospheric pressure, and the concentration of carbon  
10   dioxide  $^{13}\text{CO}_2$  or the concentration ratio  $^{13}\text{CO}_2/^{12}\text{CO}_2$  is measured.

7. An isotope gas analyzing and measuring apparatus according to Claim 6, wherein the cell volume  $V_c$  includes  
15   a net volume of the cell and volumes of pipes, valves and the pressure sensor which are in connection through the cell.